ECONOMIC CONTRIBUTION

ANALYSIS OF SC'S FORESTRY SECTOR, 2017

South Carolina
Forestry Commission

Economic Contribution Analysis of South Carolina's Forestry Sector, 2017

Puskar N. Khanal, Ph.D.
Assistant Professor
Department of Forestry and Environmental Conservation
250 Lehotsky Hall
Clemson University
Clemson, SC 29634
pkhanal@clemson.edu

Thomas J. Straka, Ph.D.
Professor
Department of Forestry and Environmental Conservation
123 Lehotsky Hall
Clemson University
Clemson, SC 29634
tstraka@clemson.edu

David B. Willis, Ph.D.
Associate Professor
Department of Agricultural Sciences
Clemson University
239 McAdams Hall
Clemson, SC 29634
willis9@clemson.edu

Abstract

South Carolina's forests are one of the foundations of the state's economy and define its natural resource environment. They represent the dominant landscape of the state, and support many important manufacturing industries. Forests are renewable resources that contribute to the growth of the state, while providing its citizens desirable aesthetic, recreational, wildlife, water quality, and other environmental values. The SC Forestry Commission initiated the 20/15 Project in cooperation with the Forestry Association of South Carolina and other partners to grow forestry's economic impact from $17.4 billion to $20 billion by 2015. Forests contribute over $21 billion annually to South Carolina's economy and provide employment to over 84,000 of its citizens.

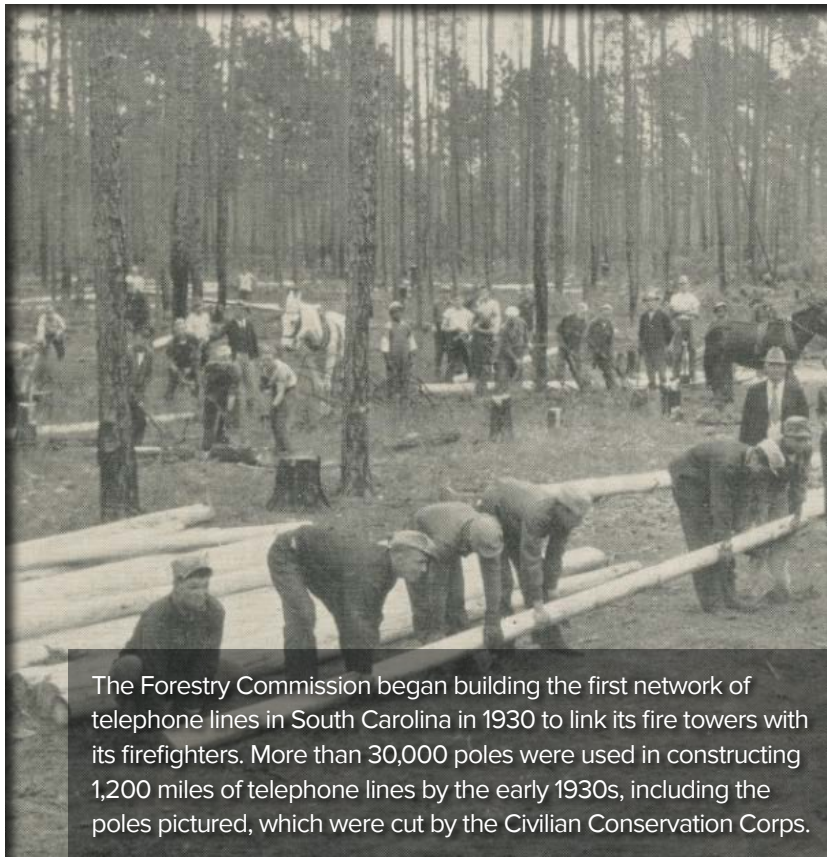
South Carolina Forestry Commission
Columbia, S.C.
April 2017

South Carolina's Forests

Early settlers wrote of luxuriant forests covering most of the state. They relied on the forests for food and shelter. Many of the state's earliest industries were based on forest products. From the late seventeen to early eighteenth centuries, the Upstate had an early ironmaking industry that was fueled by charcoal produced from thousands of acres of forestland (Ferguson and Cowan 1997). By the eighteenth century, the pitch from coastal pinelands supported a large naval stores industry. After the War Between the States, large sawmill operations sustained logging and lumbering industries. Paper manufacturing from southern yellow pine began in South Carolina in the late nineteenth century and became one of the state's largest manufacturing sectors (South Carolina Forestry Commission 2017b). Most of the Piedmont was cleared for agriculture, and towards the end of the nineteenth century, lumbering grew as an industry in the coastal plain. By the end of World War II only scattered vestiges of the virgin forest remained, but a second-growth forest had reclaimed the cut-over lands and abandoned farmland. This second-growth forest supplied most of the commercial timber cut in the state from mainly pine stands growing on previously cultivated land.

Forests helped form the character of the state and its people. The state's economic development, continuing to today, hinged on its natural resources. Forest industry is a key component of South Carolina's diversified economy and this competitive advantage will only thrive if its forests are protected, promoted, and developed to ensure sustained growth of its economy.

South Carolina's forests are the foundation of its environment and contribute many jobs to the state's economy. Large parts of its manufacturing economy rest upon that foundation, as well as huge non-manufacturing sectors like nature-based tourism and outdoor recreation. Forests cover just over two-thirds of the state (Oswalt et al. 2014). These support a tremendous economic value (not well-measured in the traditional marketplace) and this report summarizes an analysis of forestry's contribution to the South Carolina economy.



The Forestry Commission began building the first network of telephone lines in South Carolina in 1930 to link its fire towers with its firefighters. More than 30,000 poles were used in constructing 1,200 miles of telephone lines by the early 1930s, including the poles pictured, which were cut by the Civilian Conservation Corps.

The role of forests in the state's economy and social fabric was apparent to planners after the economic upheaval of the 1930s and recognition that much marginal farmland should never have been used for production of crops like cotton. From 1936 to 1947 timberland acreage in South Carolina increased by 11.4 percent. This was mainly due to over 831,500 acres of agricultural land in the Piedmont reverting to forest (McCormack and Cruikshank 1949). One USDA Forest Service report at the time noted the importance of forests to the state: "Forests are one of South Carolina's most important natural resources. They form an inseparable part of the social and economic structure of the State. Under proper management the forest resource is renewable, and because of its vital contribution to the welfare of the people, both private citizens and public officials should be more active in initiating and putting into effect conservative and permanently productive plans of forest use" (Frothingham and Nelson 1944). Over seventy years later, efforts to conserve forests continue to grow. Forestry remains an alternative to agriculture for landowners with marginal farmland.

The total land area of South Carolina (not including water bodies) is 19.2 million acres and just over two-thirds of that

area, 12.9 million acres, is forested. Almost all of that forestland is productive timberland (Brandeis et al. 2016). The acreage of forestland in the state has been relatively stable over the last fifty years. Two countertrends produced this stability: forestland and agricultural acreage have steadily been lost to urban development, while afforestation of agricultural lands added forest acres (Harper and Rominger 2013). Two important trends in forest ownership have implications that impact forestland. First, in 1986 forest industry owned about 2.7 million acres, and this has declined to just over 170,000 acres in 2015 (Tansey 1987, Brandeis et al. 2016). These are some of the most productive timberland in the state, and they are now owned by investment groups, who continue to manage them intensively. Second, nearly two-thirds of private timberland in the state is owned as family forests. These ownerships are subject to parcelization, or being split into smaller and smaller forests over time as they change hands. As these tracts become smaller, forest management becomes more difficult (Hatcher et al. 2012). Timberland area and timber volumes for inventory years since 1936 are shown in Table 1.

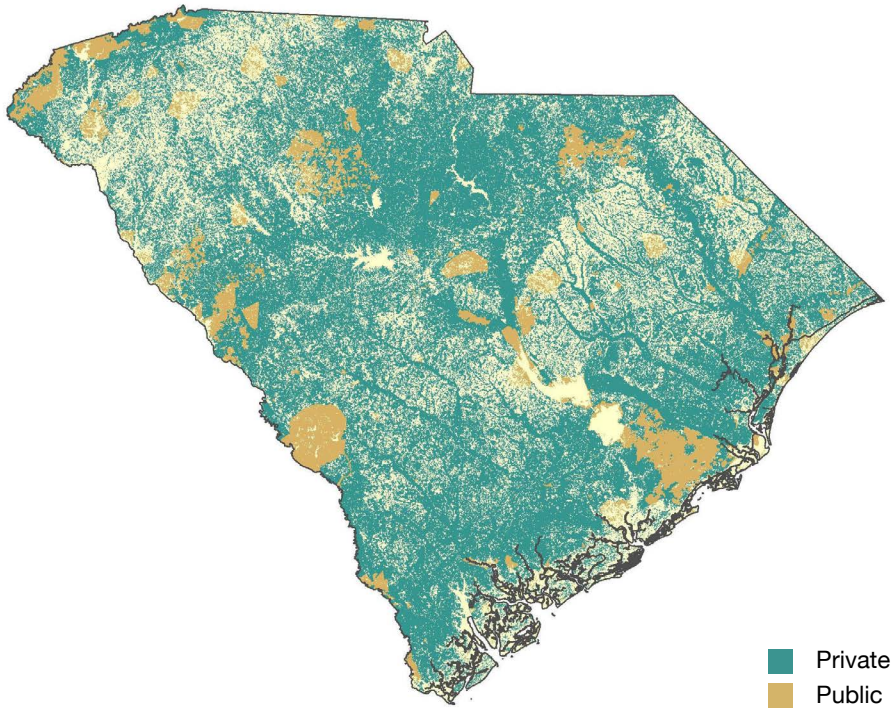
Table 1. Timberland area and timber volume for South Carolina, 1936-2015 (USDA Forest Service reports).

Year	Timberland (million acres)	Softwood Percent Area	Live Tree Volume (million cubic feet)	Softwood Timber Volume Percent
1936	10.7	73	13.4	43
1947	11.9	62	12.8	41
1958	11.9	56	12.1	41
1968	12.4	45	14.4	44
1978	12.5	45	19.7	48
1986	12.2	45	19.5	46
1993	12.5	45	17.9	45
2001	12.7	49	19.7	48
2006	12.8	46	21.5	49
2010	13.0	47	23.2	50
2015	12.8	47	25.2	52

Slightly more than half of the state's forest area is hardwood forest type and the rest is primarily southern yellow pine forest type (mainly loblolly, longleaf, and shortleaf pine). Roughly one-quarter of the state's forestland is artificially-regenerated (planted) and the rest is naturally-regenerated. These planted forest acres produce about half of the state's timber harvest (Harper and Rominger 2013). The planted forest area receives more intensive forest management and makes a disproportionate contribution to the state's timber supply, allowing for less intensive management on more sensitive natural areas (Conner et al. 2004). Retaining and expanding the high timber production potential provided by the planted forests is the key to maintaining the environmental and economic health of the state's forests and forest industry.

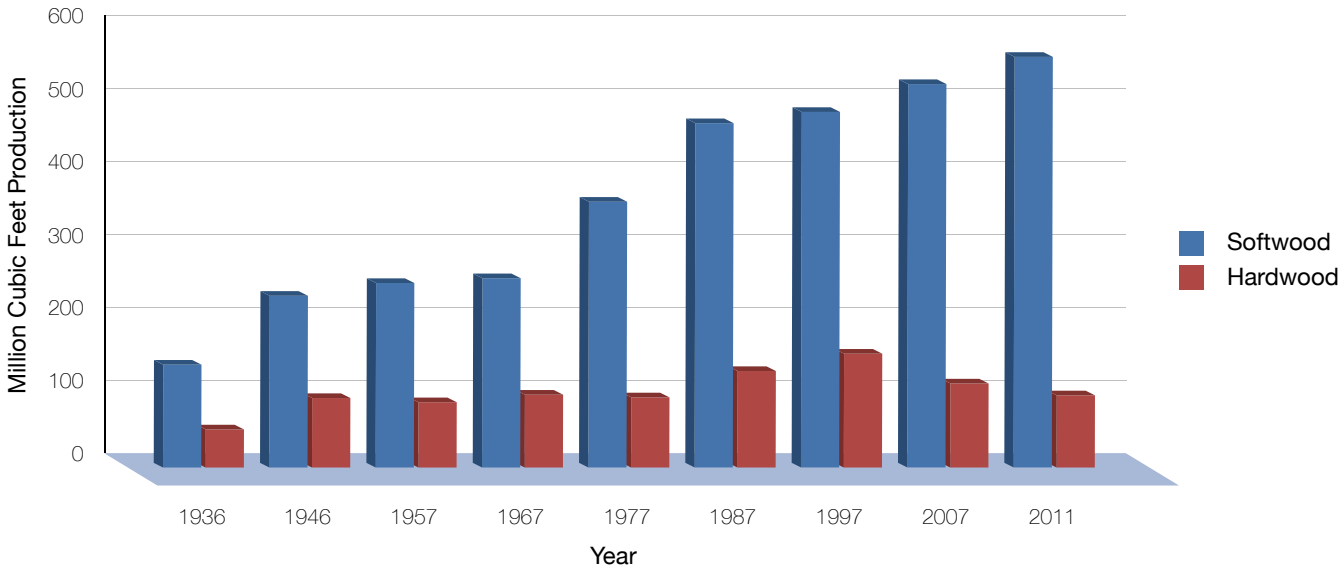
About 88 percent of South Carolina's forest area is privately-owned (Brandeis et al. 2016). The private forest ownership produces roughly 95 percent of the state's timber harvest (Mo, Straka, and Harper 2013). Of the 12 percent that is publicly-owned, about two-thirds is federally-owned, about one-fifth is state-owned, and the rest is locally-owned (Butler 2008). Of the private forestland, about 63 percent is owned by family forest owners and the rest is owned by timberland investment management groups, corporations, and forest industry (Conner 2011). Family forest owners represent the major ownership group and the largest source of timber in the state (Williams, Straka, and Harper 2012). Figure 1 shows the distribution of public and private forestland in South Carolina.

Figure 1. Private and public forestland in South Carolina (Hewes et al. 2014, Butler and Butler 2016).



Timber production supports a major industry in South Carolina. Figure 2 shows a steady increase in timber output in the state since data collection began in 1936. Softwood has shown a steady increase. Over the recent recession hardwood production had declined slightly. Over the last three-quarters of a century, softwood timber production has increased by almost 1.9 percent annually on average and hardwood production by 0.9 percent annually. That increase occurred while the timber inventory nearly doubled. Proper forest management will continue to sustain a forest that can support a thriving forest industry, along with wildlife, recreation, soil, water, and other values.

Figure 2. Softwood and hardwood timber production for selected year in South Carolina, million cubic feet (Johnson et al. 2008, Bentley et al. 2014).



South Carolina's forestry sector was affected by major trends that coalesced during the late 1980s to create an uneven distribution of forestland in the state: major reforestation following Hurricane Hugo, reforestation under the federal Conservation Reserve Program, and reforestation of recently harvested lands that were in the federal Soil Bank Program of the late 1950s. One result of this was an immediate growth in private tree nurseries in the state to meet the increased demand for seedlings needed for reforestation and afforestation. By the turn of the century, this massive reforestation had created a "wall of wood" that was beginning to enter the pulpwood market. Industries that utilized pulpwood-sized material expanded. Three oriented strand board (OSB) mills were attracted to the state: a Norbord mill and two Grant Forest Products mills (later acquired by Georgia Pacific).

A main result of the "Great Recession" was a collapse in housing construction, causing a significant drop in demand for solid wood products (especially lumber). This occurred at the same time the reforested acres were growing out of pulpwood size into sawtimber-sized age classes. This did not bode well for the sawtimber market. However, forest industry continued to grow in the area of medium density fiberboard and heavy density fiberboard (MDF/HDF) that utilized small diameter trees and mill residues. Biomass plants have also moved into the state over the last decade: an Ameresco facility and two EDF Renewable Energy facilities. Market pressure has caused a redefinition of timber product size classes. As housing construction steadily improved, the sawmill industry expanded to take advantage of the abundance of sawlog-sized trees. New mills were built in places and existing sawmills expanded. The expansion has been much more diverse than the "standard forest products," of paper, lumber, and chips. Even timberland itself has been steadily changing hands among investment groups across the state. Surprisingly, the state has more timber than ever recorded, with ample timber supplies to support further forestry sector growth.

Economic activity in the forest products sectors involve all areas of the state, and include huge operations like pulp and paper mills (Domtar in Bennettsville, International Paper in Eastover and Georgetown, Kapstone in North Charleston, Resolute in Catawba, WestRock in Florence, and Sonoco in Hartsville) and dozens of large sawmills. Traditionally, large pulp and paper mills and sawmills tend to be thought of as the large capital investments. Many of the newer forestry-based manufacturing plant investments rival some of the traditional capital-intensive industries in terms of economic potential. Colombo Energy's investment in a new wood pellet plant in Greenwood represents an investment of $119 million. Swiss Krono Group's expansion of its engineered wood products plant in Barnwell County represents $230 million of investment. Ameresco's renewable energy fuel facility at the Savanah River site in 2012 represented a $795 million investment, and even a "small" facility like Carolina Chip's planned wood chip mill in North Charleston involves $32 million of investment (South Carolina Forestry Association 2016). South Carolina's forestry

Colombo Energy's new wood pellet plant in Greenwood, S.C., represents an investment of $119 million.

sector is becoming much more diversified as the state's timber output is recognized for its potential to support a much wider range of forest products than lumber and paper. This is reflected in the strength and increasing diversity of the forestry sectors that support the state's manufacturing growth.

Forest products exports play a huge role in generating demand for the forestry sector production. In 2014 forest products exports were $1.5 billion. Over the preceding decade these exports increased 8 percent annually. Nearly 80 percent of these exports left the state via the port of Charleston (with top trading partners being China, Mexico, Canada, and Germany). The top two forest products exports were paper and paperboard and wood pulp. Solid wood products exports have shown remarkable growth since the recession and emerging export markets include furniture, wood-based chemical products, and non-traditional products like prefabricated buildings (South Carolina Forestry Commission 2014).

In 2008, the South Carolina Forestry Commission took the lead in conducting an economic contribution study of forestry in the state (based on then-current 2006 data). The study revealed a strong industry with $17.4 billion in total economic contribution; it also showed that forestry was the state's leading manufacturing industry in terms of employment (90,000 total jobs) and labor income ($4.1 billion). Recognition of the forest industry's even greater potential economic contribution led the Commission to initiate the 20/15 Project in cooperation with the South Carolina Forestry Association and other allies. The project was designed as a way to help the forest industry grow out of the "Great Recession" and expand its already important role in improving South Carolina's economic and environmental health. The goal was to increase forestry's economic contribution from $17.4 to $20 billion by 2015 and increase employment by about 14,000 jobs. This study serves to validate the project's efforts at achieving the $20 billion goal.

The Input-Output Model and Contribution Analysis

Forests and the products produced from them generate a significant economic contribution to the well-being of South Carolina residents, derived through the economic activity associated with both extractive consumptive uses (such as harvesting trees) and non-consumptive uses (such as forest recreation) of the state's natural resources. Moreover, the direct expenditures on forestry-based economic activities have spillover, or indirect and induced, effects on other sectors of the state economy which result in additional economic activity (Miller and Blair 2009).

Input-Output (I-O) analysis is a technique commonly used to measure the total, or overall, economic contribution of expenditures in one industry, or sector, of the economy on the overall level of economic activity. I-O models accomplish this task by tracing the economic linkages of consumer and/or industry expenditures in one or more industries to all other industries within the economy. I-O models also systematically capture expenditure linkages between industries and other economic agents, such as households and government. For example, consumer expenditures received by the producers of forestry-based products cause those producers to purchase more inputs to produce additional forestry-based products. This economic activity generates additional labor payments to both those employees working in the industry that supply the forestry-based product or service, and those employees that supply the inputs used by forestry-based industries to produce their final product. The additional labor payments received by households are then respent by the households and generate additional economic activity (Leontief 1986).

Expenditures tied directly to the primary economic activity or activities of interest are referred to as the direct effect in I-O analysis. For example the direct effect (expenditure) for a weekend forest recreation experience may consist of expenditures for transportation, dedicated recreation supplies, food, and lodging. But these direct effects only partially account for the total economic impact of the recreation activity. The direct effect generates indirect and induced effects which contribute to the total level of economic activity. To continue with the recreation example, businesses affected by the direct recreation expenditure will purchase inputs from other businesses to produce the goods and services purchased by the recreationist. This secondary impact is referred to as the indirect effect. Moreover, the salaries and profits paid to employees and owners of the indirectly affected industries allow for additional purchases of South Carolina products by those individuals, thus setting off another round of economic activity that form the induced effect. The sum of the direct, indirect, and induced

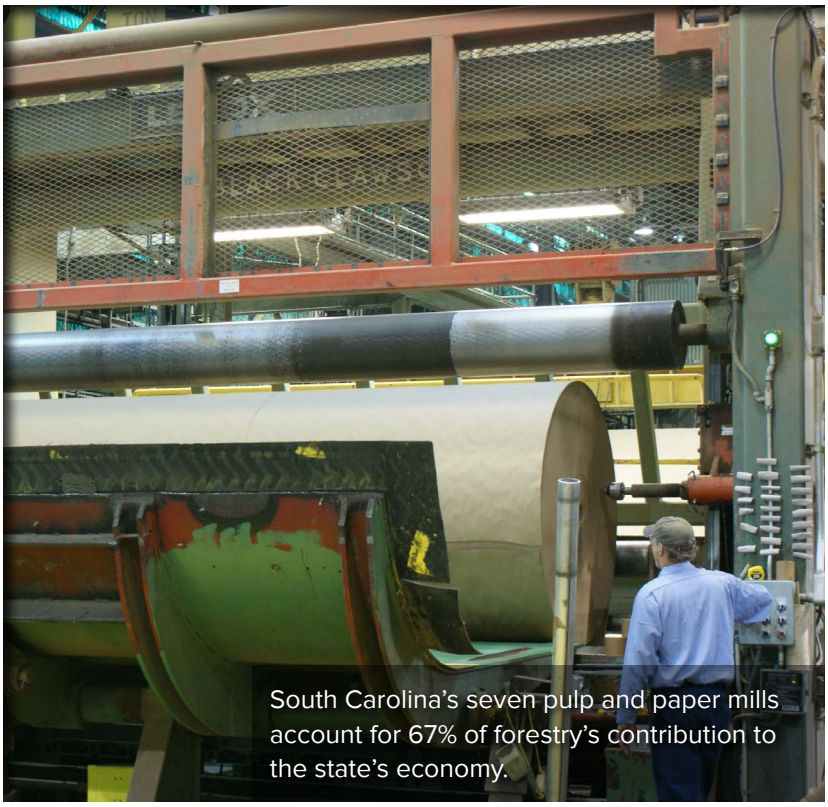
effects comprise the total economic impact of dollars directly injected into one sector of the state economy. This impact is summarized by the economic multiplier for the industry sector that translates one dollar of direct expenditure in the economic sector into a total statewide economic impact. To illustrate, an economic multiplier of 1.5 implies that a dollar of direct expenditure in a specific economic sector generates a total economic impact of $1.50 on the state economy (Miernyk 1965).

To summarize, total economic impact consists of three impacts:

- Direct impacts that are those effects generated within a particular industry sector that impact the state's economy.
- Indirect impacts that are effects between sectors. One industry sector causes additional (or less) activity in another sector.
- Induced impacts that are the domino effect of changes in expenditures rippling through the economy.

Due to its systematic accounting structure, I-O analysis is especially useful for capturing the total impact that the direct expenditure in one industry (or sector) of the economy has on the overall state or sub-state economy (Henderson et al. 2017). Relying on the multiplier effect, economic impact analysis is commonly used to estimate the total impact that a specific increase or decrease in demand (expenditures) within a given existing industry or set of industries will have on total economic activity in a state or sub-state region. I-O analysis is also commonly used to estimate the total economic impact attributable to the introduction of a new firm or new tax policy into a local or state economy in regional policy analysis. An emerging new use of I-O analysis is to assess the economic contribution a particular industry sector, or group of industries, has on total economic activity within a state or sub-state regional economy (Watson et al. 2007).

It is this latter I-O application that is used in this study. We used the contribution analysis interpretation to estimate the contribution that South Carolina's forestry-based sectors have on the overall state economy. Specifically, we estimated the reduction in economic activity that would occur in South Carolina if the forestry sectors ceased to exist. Hence, the contribution analysis estimates the economic contribution that specific sets of forestry-based industries contribute to the overall South Carolina economy when all direct, indirect, and induced effects are accounted for. Alternatively stated, an I-O contribution analysis captures the ripple (or multiplier) effect that dollar expenditures in each forestry-based sector of the economy have on the overall level of state economic activity.



South Carolina's seven pulp and paper mills account for 67% of forestry's contribution to the state's economy.

A South Carolina I-O model was developed to estimate the economic contribution of forest-based activities to South Carolina's economy. The model was developed using the IMPLAN (Impact Planning) modeling system (IMPLAN 2017). IMPLAN is a highly-respected I-O model that is commonly used for state-level and sub-state level estimation of economic impacts. Other recent I/O analysis related to forestry and natural resources in the state have also used IMPLAN (Hughes 2015, London 2015), as did prior studies that addressed the economic contribution of natural resources to the South Carolina economy (Division of Research 2009, Willis and Straka 2016).

The most recent version of IMPLAN (2014 version) divides economic activity into one of 536 mutually exclusive economic sectors (industry types); we used the most recent 2015 data

available for the model (IMPLAN 2017). Our contribution analysis uses the IMPLAN industry structure to create six mutually exclusive forestry-based sectors within the South Carolina economy: (1) Timber, (2) Logging, (3) Solid Wood Products, (4) Wood Furniture, (5) Pulp and Paper Products, and (6) Forest-Based Recreation.

Our contribution analysis of the economic contribution of each of the forestry-based economic sectors focuses on several key economic variables to summarize the economic contribution of each of the forestry-based sectors to the overall economy. These key variables are value added (often called Gross State Product), employment (number of full-time and part-time jobs), earned income (labor and proprietor income), and total industry output (total dollar value of all sales) (Miller and Blair 2009).

Value added measures each sector's net contribution to the state's economy. It is the difference between a sector's total output (revenue from sales) and the cost of its intermediate inputs (exclusive of labor cost). Value added is generated when productive inputs (man-made resources and natural resources) are efficiently combined to produce products that are valued by society. Value added has three major components: (1) earned income (labor and proprietor income); (2) property income (corporate profit); and (3) indirect business taxes. Earned income is a key component of value added (Gross State Product) and is also reported for each forestry-based sector in this study because it is indicative of consumer purchasing power. Earned income is employee compensation, primarily in the form of wages and salaries, plus net profits to proprietors (non-corporate owner operators). Property income is another measure of value added and includes returns to capital in the form of corporate profits, depreciations charges, and other accounting measures of corporate profitability. Indirect business taxes, the third value added component, consist of sales taxes, excise taxes and other business taxes. Total industry output is the value of total output or total sales revenue and is equal to the cost of intermediate inputs (exclusive of labor) plus value added (Miller and Blair 2009).

This economic contribution analysis considers both consumptive and non-consumptive uses of the South Carolina forest base. Consumptive use involves the extraction of natural resources for additional processing and sale to either other industries for their further productive use or consumers for final purchase. For example a logging company may harvest forest timber and subsequently process the timber into lumber. The lumber may in turn be sold to a furniture manufacturer for final conversion into a table and sold to a consumer as a final purchase. An example of non-consumptive use of the forest is the economic value recreationists receive from camping, hiking, and bird watching in a forested area. In some cases, forest recreation activities can be tied to service providers (such as guide services for hunting or boating) while in other cases the activities are linked to direct purchases by households for recreational supplies and permits.

The primary data used in the contribution analysis were taken from the 2015 IMPLAN data base, the most recent IMPLAN data base, and augmented with data collected from the "Quarterly Census of Employment and Wages" (Bureau of Labor Statistics (2015), South Carolina Forestry Commission (2017a), and the "National Survey of Fishing, Hunting, and Wildlife-Associated Recreation: South Carolina" (U.S. Fish and Wildlife Service (2014). Data taken from sources external to IMPLAN were converted from retail prices to producer prices and subsequently distributed to the appropriate IMPLAN industry in each constructed forestry-based sector. Moreover retail expenditure data were margined using the IMPLAN default values to account for expenditure leakages outside South Carolina. Retail, wholesale, and transportation expenses were margined to account for the fact that a portion of purchase expenditure leak out of the state economy when goods are produced outside of the state. These expenditure leakages do not contribute to either indirect or induced state spending and must be netted out before applying the multiplier to calculate total economic contribution. Each direct expenditure item in each direct expenditure impact vector is divided by their respective diagonal element of the Leontief inverse matrix to control for the fact that many industries purchase from themselves (Watson et al. 2015). Failure to make this minor adjustment results in an overestimate of the total economic contribution. The IMPLAN GNP deflator tool was used to convert all reported dollar values into 2017 dollars.

The six mutually exclusive forestry-based sectors were aggregated from 41 of the 536 interrelated IMPLAN sectors. These sectors consist of the wood production sectors, manufacturing sectors heavily dependent on wood resources as a production input, and two sectors that supported the constructed aggregate forestry sector. Except for the two support sectors, all other sectors use the reported output values from the 2015 IMPLAN model inflated to 2017 dollars. The two support sectors, Support

Activities for Agriculture and Forestry (IMPLAN sector 19) and Commercial and Industry Machinery & Equipment Repair and Maintenance (IMPLAN sector 507), were rescaled to capture only their economic activity within the constructed forestry sector. The direct industry output value for IMPLAN Industry 19 (support activities for agriculture and forestry) was rescaled by multiplying the IMPLAN state value for this sector by the ratio of South Carolina forestry workers to South Carolina forestry and agricultural workers. The data used to develop this ratio were provided by the U.S. Department of Labor Quarterly Census of Employment and Wage data (Bureau of Labor Statistics 2015). IMPLAN industry 507 (Commercial and industrial machinery & equipment repair and maintenance) was also rescaled to measure only the proportion of this sector's total statewide economic activity related to the constructed forestry sector. The rescaling of this sector was accomplished by multiplying IMPLAN's statewide value for this sector by the ratio of the sum of the dollar output from all other industries in the constructed forestry sector to the total value of all state output. All industry output values in the forestry sector are in producer prices and are not margined. Appendix Table A1 includes descriptions of the aggregated sectors used in the IMPLAN model, by IMPLAN and NAICS codes, along with adjustments or scaling applied to the individual IMPLAN sectors.


Marsh Furniture in Pamplico is one of over 700 secondary forest product companies in South Carolina that make a value-added product.

Economic Contribution Results

We attempted to retain consistency with prior economic impact reports so that the results are comparable over time (Conner et al. 2009, Hughes 2015, Willis and Straka 2016). Results are in 2017 dollars using the six forest industry sector groupings described earlier; these groupings are consistent with the prior studies and follow the general definitions and methodology common for forestry contribution analyses (Henderson et al. 2017). Direct, indirect, and induced impacts were calculated for each aggregate sector and each sector was described by the four standard criteria: employment, labor income, value added, and total industry output.

Employment is the number of jobs supported by forestry. Labor income represents wages paid to salaried employees and proprietors. Value Added (also referred to as Gross State Product) is the sum of labor income, indirect business taxes, and property income. Output is the sum of value added and intermediate input cost. Individual column effects (direct, indirect, and induced) sum to the total effect. However, labor income and value added do not sum to output for two reasons: first, labor income is a component of value added, and second, the value (cost) of intermediate products purchased is not reported. Total sales (output) minus the value (cost) of intermediate goods is equal to value added.

Economic contribution is discussed in terms of the six aggregated forestry sectors identified earlier and defined in Appendix Table A1. The six forestry sectors are:

1. Timber,
2. Logging,
3. Solid wood products,
4. Wood furniture,
5. Pulp and paper, and
6. Forest-based recreation.

Forest industry traditionally has been dominated by pulp and paper and solid wood products. That domination still exists, with two sectors accounting for almost 90 percent of both the industry's direct and total impacts. Those two sectors account for over

three-quarters of labor income from the industry. Those same sectors are the core manufacturing sectors, and thus account for roughly 80 percent of value added in the industry (Figure 3).

Figure 3. Total economic contribution (measured in dollars of total output) by the six aggregated forestry sectors, South Carolina, 2017.

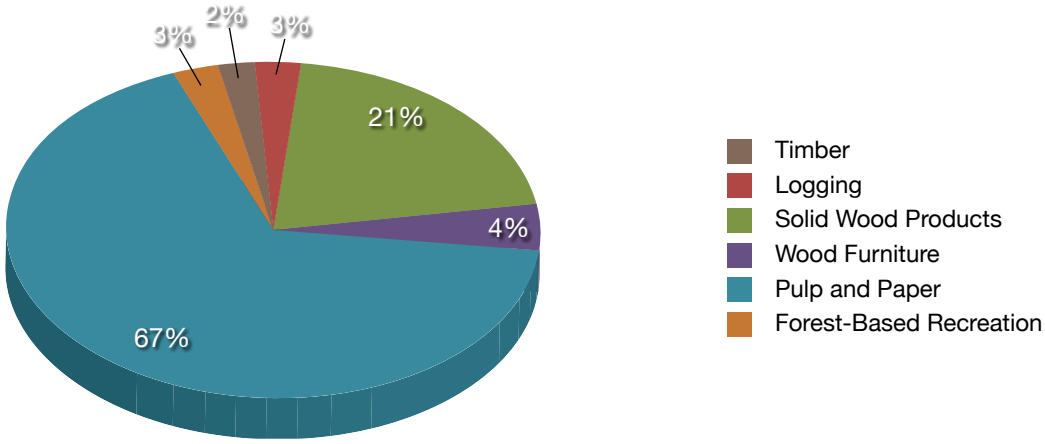


Table 2 presents the direct and total impacts for South Carolina's forestry sectors. Since 2006 total economic contribution has increased just over $3.6 billion, from $17.4 billion to $21.0 billion. This time span includes the major recession and the various aggregated forestry sectors do show some changes in terms of contribution that likely resulted from shifts in capital and labor efficiencies as the industry adjusted and reacted to the recession. Labor income and value added showed similar increases since 2006 (from $4.1 billion to $4.5 billion and from $7.0 to $8.8 billion, respectively). Labor income per employee increased by nearly $9,000, from $54,400 to $63,258. Note that numbers presented in Table 2 and all subsequent tables may not add up precisely to the totals due to very small rounding errors.

Table 2. Economic effects of forestry sector for South Carolina based on IMPLAN model, 2017.

Sector	Employment	Labor income	Value added	Total industry output
	Number	----------Million Dollars----------		
Direct effects of aggregate wood products sectors				
Timber	3,733	149	198	297
Logging	4,404	223	228	375
Solid wood products	8,543	452	730	2,502
Wood furniture	2,694	110	275	621
Pulp and Paper	12,379	1,215	3,141	9,319
All wood products	31,754	2,149	4,572	13,114
Forest-based recreation	3,362	73	366	439
All forest products	35,116	2,221	4,939	13,552
Total contribution values[a]				
Timber	5,244	209	305	482
Logging	6,622	309	379	641
Solid wood products	22,010	1,084	1,728	4,444
Wood furniture	4,720	201	429	923
Pulp and Paper	41,672	2,603	5,508	14,009
All wood products	80,268	4,406	8,350	20,500
Forest-based recreation	4,156	107	424	545
All forest products	84,424	4,512	8,774	21,045

[a] Total impact values (direct + indirect + induced effects) are reported in 2017 dollars for 2015 wood product output levels.

Timber

The timber aggregated sector consisted of timber operations, companies that own land for the purpose of growing timber, site preparation companies, tree planting contractors, forestry consultants, and includes tree nurseries and the gathering of forest products. Support activities from timber production to wildfire fighting, Christmas tree production, and pine straw operations fell into this sector. Federal, state, and university forestry employees were included in this sector as additions to the traditional analyses. This was the smallest sector in terms of direct and total contribution. Still, small is relative. Total economic contribution was $482 million and direct contribution was nearly $300 million.

The timber sector's direct and total outputs declined since 2006 by roughly one half. Several sectors seem to have been impacted by the recent recession and still are recovering. The direct output effect supports 3,733 South Carolina jobs and provides $149 million in labor income. As expected, the number of direct employees is down since 2006, but only by about three percent. Value added or gross state product is nearly $200 million. The indirect effect, jobs and income created in South Carolina from the purchase of inputs and services from South Carolina industries to support the direct effect, resulted in about 500 jobs and over $50 million of additional economic activity. The induced effect, which is primarily driven by additional household labor income generated by the direct and indirect effects, plus any government spending of tax payments received, via the direct and indirect effects, adds another 1,014 jobs and an increase in economic activity of $131 million.

Table 3. Annual economic contribution of South Carolina's timber sector, 2017.

Contribution	Direct Effect	Indirect Effect	Induced Effect	Total Effect
Employment (jobs)	3,773	497	1,014	5,244
Labor Income ($)	149,342.599	20,131,984	39,281,599	208,756,182
Value Added ($)	198,323,775	33,686,662	73,214,406	305,224.843
Output ($)	296,896,011	54,689,951	130,880,840	482,466,802

Logging

The logging aggregated sector consisted of the traditional commercial logging activities, that included harvesting, processing, and transporting timber from the forest to the mill. Like the timber sector, it also has decreased since 2006. Direct output was $375 million and total output was just over $640 million. Still the sector accounted for 4,404 direct effect jobs, and after indirect and induced effects, accounted for 6,622 jobs (about four percent less jobs in terms of total output than 2006). Following the Great Recession, consolidation and greater mechanization within the logging sector resulted in an overall reduction in jobs. Surprisingly, labor income is up since 2006 by 25 percent. Direct effect value added was $228 million and the total value added was $379 million. Value added was down by about 30 percent. Like timber, this seems to be another sector that is still recovering from the recession.

Table 4. Annual economic contribution of South Carolina's logging sector, 2017.

Contribution	Direct Effect	Indirect Effect	Induced Effect	Total Effect
Employment (jobs)	4,404	719	1,499	6,622
Labor Income ($)	223,152,714	27,351,696	58,053,841	308,558,251
Value Added ($)	228,307,049	42,873,915	108,229,323	379,410,287
Output ($)	374,588,061	72,928,112	193,439,496	640,955,669

Solid Wood Products

The solid wood products aggregated sector is a diverse set of companies that produce a variety of solid wood products. These include nearly 100 primary mills and over 700 hundred secondary mills scattered across the state (South Carolina Forestry Commission 2017a). Examples include traditional lumber products, beams, poles, siding, veneer, plywood, engineered wood members and trusses, millwork, containers, pallets, wood windows, wood pellets, and wood chips. Appendix Table A1 includes a much wider mix of products, indicating that a wide range of wood-using plants and mills across the state fall into this sector. Wood preservation and its treated products fall into this sector, as well as prefabricated

wood buildings. Plus the wholesale trade supporting the sale of these products is included.

This is one of the two "big" aggregated sectors with a direct output of $2.5 billion and a total output of $4.4 billion. Direct employment is over 8,500 jobs and total employment is just over 22,000 jobs. These tend to be well-paying jobs with annual wages being over $50,000 per employee. This is a manufacturing sector and value added is significant: direct value added is $730 million and total value added is $1.7 billion. In terms of direct effects this sector is down since 2006, but when total effects are considered, all four measures (impacts) are up by roughly 10 percent or more.

Table 5. Annual economic contribution of South Carolina's solid wood products sector, 2017.

Contribution	Direct Effect	Indirect Effect	Induced Effect	Total Effect
Employment (jobs)	8,543	8,205	5,362	22,010
Labor Income ($)	451,781,598	427,946,792	203,983,308	1,083,711,698
Value Added ($)	730,194,514	617,805,824	379,978,772	1,727,979,110
Output ($)	2,501,754,859	1,263,173,704	679,546,938	4,444,475,501

Wood Furniture

The wood furniture aggregated sector consists of companies that manufacture wood kitchen cabinets and countertops, both upholstered and nonupholstered wood furniture, wooden office furniture, architectural woodwork and millwork, boxsprings, blinds and shades, and even burial caskets. The state forest products directory lists nearly 200 furniture manufacturers (South Carolina Forestry Commission 2017a). The sector had a direct effect output of $621 million and a total effect output of $923 million. This is slightly down from 2006. It employs 2,694 individuals with a sector labor income of $110 million. On a total effect basis, employment is 4,720 individuals and the labor income is just over $200 million. The total effect value added for the sector is $429 million. The market for South Carolina furniture is a global one.

Table 6. Annual economic contribution of South Carolina's wood furniture sector, 2017.

Contribution	Direct Effect	Indirect Effect	Induced Effect	Total Effect
Employment (jobs)	2,694	1,049	977	4,720
Labor Income ($)	109,646,151	53,691,962	37,879,448	201,217,561
Value Added ($)	274,569,532	83,944,188	70,558,183	429,071,903
Output ($)	620,601,228	176,317,614	126,189,410	923,108,252

Pulp and Paper

The pulp and paper aggregated sector is the preeminent forestry sector in the state. In terms of total effect, it represents over half of forestry sector employment and labor income, over 60 percent of value added, and two-thirds of total output. The main contribution comes from the state's seven large pulp and paper mills. However, this sector also includes chemical manufacturing and bioenergy that make a significant contribution. Direct employment is 12, 379 jobs and when indirect and induced effects are accounted for, total employment is 41,672 jobs. In terms of direct effect, jobs are slightly off from 2006, but in terms of total effect, employment is up by 17 percent. This is a manufacturing sector that produces significant value added (or gross state product) of $5.5 billion in terms of total effect.

Table 7. Annual economic contribution of South Carolina's pulp and paper sector, 2017.

Contribution	Direct Effect	Indirect Effect	Induced Effect	Total Effect
Employment (jobs)	12,379	16,534	12,758	41,672
Labor Income ($)	1,214,764,793	893,938,362	494,647,783	2,603,350,938
Value Added ($)	3,141,204,416	1,445,825,504	921,271,961	5,508,301,882
Output ($)	9,319,299,041	3,042,307,309	1,647,723,219	14,009,329,568

Forest-Based Recreation

The forest-based recreation aggregated sector is derived mostly from hunting, fishing, and wildlife viewing. This is one of the smaller sectors with $439 of direct effect output and $545 million of total effect output. Direct effect employment is 3,362 jobs ($73 million labor income) and total effect employment is 4,156 jobs ($107 million labor income).The state is well-endowed with forest resources that provide environmental services that don't get captured well in an input-output analysis. Water quality for example is fundamentally related to forest cover. Certainly the model's estimate of forest recreation impact is a conservative one.

Table 8. Annual economic contribution of South Carolina's forest-based recreation sector, 2017.

Contribution	Direct Effect	Indirect Effect	Induced Effect	Total Effect
Employment (jobs)	3,362	276	518	4,156
Labor Income ($)	72,663,462	13,850,758	20,041,944	106,556,164
Value Added ($)	366,383,597	20,372,244	37,386,197	424,142,038
Output ($)	438,553,520	39,339,488	66,791,304	544,684,312

Total Forestry Sector

The total forestry sector values are simply the sum of the six aggregated sector values. Total economic contribution of forestry for the state of South Carolina is just over $21 billion. The forestry sector direct effect is $13.6 billion. Direct effect employment was just over 35,000 jobs ($2.2 billion of labor income) and total effect employment was over 84,000 jobs ($4.5 billion of labor income). This equates to wages in the sector itself (direct effect) of $63, 258 per person, and when the indirect and induced effects are considered (total effect) average wages are reduced to $53,446 per person. Value added is high in the sector at nearly $8.8 billion dollars (total effect).

Compared to 2006, sector employment decreased from 90,624 to 84,425. This is likely due to the major recession that occurred over that period and technology improvements that increased labor efficiency and wages. Due to increased revenues driven by growing demand for forestry products, total forestry total industry output increased and, the increased revenue when coupled with the adoption of efficient technological changes, caused value added and labor income to increase. Labor income was down slightly for the sector itself (direct effect) over that time period, but when indirect and induced effects are considered, it is up 11%. Value added increased by 26 percent (total effect) and is a primary reason total output increased by nearly $3.6 billion since 2006. Detailed forest industry sector contributions are shown in Appendix Table A2.

Table 9. Annual economic contribution of South Carolina's total forestry sectors, 2017.

Contribution	Direct Effect	Indirect Effect	Induced Effect	Total Effect
Employment (jobs)	35,116	27,280	22,029	84,425
Labor Income ($)	2,221,351,318	1,436,911,554	853,887,923	4,512,150,795
Value Added ($)	4,938,982,883	2,244,508,337	1,590,638,843	8,774,130,063
Output ($)	13,551,692,720	4,648,756,178	2,844,571,207	21,045,020,105

Summary

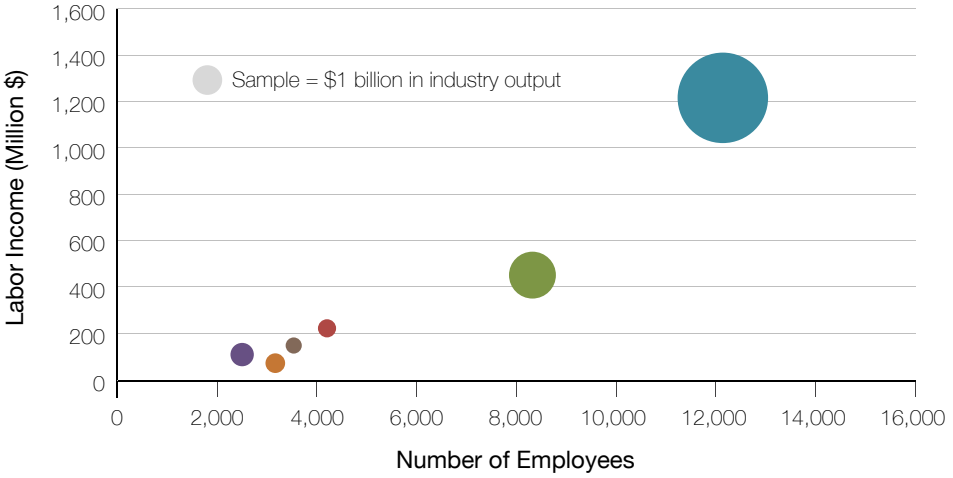
Over the last decade total output for South Carolina's forestry sector has increased by $3.6 billion, despite a major recession that occurred midway during that time period. Total output increased from $17.4 billion to $21.0 billion since 2006. Employment declined, but, on a total effect basis, labor income increased 11% and income per employee increased 19%.

Figure 4 illustrates the contributions of the various sectors. Number of employees and labor income by sector are

plotted with the size of each point indicating the total output of that sector. The dominant sector clearly stands out: pulp and paper (no matter how measured). Solid wood products is in the clear second place, but does not come close to pulp and paper in terms of all three parameters. The remaining four sectors seem less significant, but should not be underestimated in their importance to the state. They are being compared to giants. Relative to other sectors of the state's economy, all six sectors are significant. What drives the forest economy in the state becomes fairly obvious from Figure 4.

The results show some of the sectors have responded to the sluggish economy less well than others. Probably more significant is the current growth and industry expansion that will show up in the next model of the forest economy in a few years. The SC Forestry Commission in cooperation with the Forestry Association of South Carolina and other partners set a goal for the forestry sector of reaching $20 billion in total economic output by 2015. That criterion was soundly met with over $1.0 billion to spare. South Carolina has a vibrant forest economy and a productive timberland base that can be expected to continue to support expansion of the forest economy.

Figure 4. Direct economic effects of forestry sectors in South Carolina, 2017.



Sector	Direct Industry Output (Million $)
Pulp and Paper	$9,319
Solid Wood Products	$2,502
Wood Furniture	$621
Recreation	$439
Logging	$375
Timber	$297

References

Bentley, J.W., J.A. Cooper, and M. Howell. 2014. South Carolina's Timber Industry – Timber Product Output and Use, 2011 (e-Science Update SRS-096). Asheville, NC: USDA Forest Service, Southern Research Station.

Brandeis, T.J., A. Hartwell, C. Brandeis, K. Randolph, and S. Oswalt. 2016. Forests of South Carolina, 2015 (Resource Update FS-102). Asheville, NC: USDA Forest Service, Southern Research Station.

Bureau of Labor Statistics. 2015. Quarterly Census of Employment and Wages .Washington, DC: United States Department of Labor, Bureau of Labor Statistics. Online at: https://www.bls.gov/cew.

Bureau of Labor Statistics. 2017. BLS Standard for Sector Aggregation Titles for NAICS. Washington, DC: United States Department of Labor, Bureau of Labor Statistics. Online at: https://www.bls.gov/bls/naics_aggregation.htm.

Butler, B.J. 2008. Family Forest Owners of the United States, 2006 (General Technical Report NRS-27). Newtown Square, PA: USDA Forest Service, Northern Research Station.

Butler, B.J., and S. M. Butler. 2016. Family Forest Ownerships with More Than 10+ Acres in South Carolina, 2011-2013 (Research Note NRS-235). Newtown Square, PA: USDA Forest Service, Northern Research Station.

Conner, R.C. 1998. South Carolina's Forests, 1993 (Resource Bulletin SRS-25). Asheville, NC: USDA Forest Service, Southern Research Station.

Conner, R.C., T. Adams, B. Butler, et al. 2004. The State of South Carolina's Forests, 2001 (Resource Bulletin SRS-96). Asheville, NC: USDA Forest Service, Southern Research Station.

Conner, R.C., T.O. Adams, T.G. Johnson, and S.N. Oswalt. 2009. South Carolina's Forests, 2006 (Resource Bulletin SRS-158). Asheville, NC: USDA Forest Service, Southern Research Station.

Conner, R.C. 2011. South Carolina, 2010--Forest Inventory and Analysis Factsheet (e-Science Update SRS-041). Asheville, NC: USDA Forest Service, Southern Research Station.

Division of Research. 2009. Green Means Green: 30 Billion Reasons Why Life's Better Outdoors – The Economic Impact of South Carolina's Natural Resources. Columbia, SC: Division of Research, Moore School of Business, University of South Carolina.

Ferguson, T.A., and T.A. Cowan. 1997. Iron plantations and the eighteenth- and nineteenth-century landscape of the northwestern South Carolina Piedmont. In: Stine, L.F., M. Zierden, L.M. Drucker, and C. Judge (eds.). Carolina's Historical Landscapes: Archaeological Perspectives. Knoxville, TN: The University of Tennessee Press. p. 113-144.

Frothingham, E.H., and R.M. Nelson. 1944. South Carolina Forest Resources and Industries (Miscellaneous Publication 552). USDA Forest Service, Appalachian Forest Experiment Station. Washington, DC: Government Printing Office.

Harper, R.A., and B.E. Rominger. 2013. South Carolina, 2012—Forest Inventory and Analysis Factsheet (e-Science Update SRS-083). Asheville, NC: USDA Forest Service, Southern Research Station.

Hatcher, J.E., T.J. Straka, R.A. Harper, and T.O. Adams. 2012. Shifting private timberland ownership in South Carolina: Implications for management intensity. Open Journal of Forestry 2(4):279-285.

Henderson, J.E., O. Joshi, S. Tanger, et al. 2017. Standard procedures and methods for economic impact and contribution analysis in the forest products sector. Journal of Forestry 115(2):112-116.

Hewes, J.H., B.J. Butler, G.C. Liknes, M.D. Nelson, and S.A. Snyder. 2014. Public and Private Forest Ownership in the Conterminous United States: Distribution of Six Ownership Types – Geospatial Dataset. Fort Collins, CO: USDA Forest Service, Research Data Archive. Online at: https://doi.org/10.2737/RDS-2014-0002.

Hughes, D.W. 2015. Economic Impact Analysis of SC's Forestry Sector, 2015: Contribution of Forests and Forest Products to the South Carolina Economy. Columbia: SC: South Carolina Forestry Commission.

IMPLAN. 2017. IMPLAN. Online at www.IMPLAN.com (accessed 24 February 2017).

Johnson, T.G., J.W. Bentley, and M. Howell. 2008. Historical Trends of Timber Product Output in the South (Resource Bulletin SRS-138). Asheville, NC: USDA Forest Service, Southern Research Station.

Knight, H.A., and J.P. McClure. 1969. South Carolina's Timber, 1968 (Resource Bulletin SE-13). Asheville, NC: USDA Forest Service, Southeastern Forest Experiment Station.

Leontief, W.W. (ed.). 1986. Input-Output Economics (Second Edition). New York: Oxford University Press.

London, J.B. 2015. The Impact of the South Carolina Agribusiness Sector on the South Carolina Economy. Clemson, SC: London and Associates.

Miller, R.E., and P.D. Blair. 2009. Input-Output Analysis: Foundations and Extensions (Second Edition). Cambridge, UK: Cambridge University Press.

McCormack, J.F., and J.W. Cruikshank. 1949. South Carolina's Forest Resources, 1947 (Forest Survey Release No. 28). Asheville, NC: USDA Forest Service, Southeastern Forest Experiment Station.

Miernyk, W.H. 1965. The Elements of Input-Output Analysis. New York: Random House.

Mo., J., T.J. Straka, and R.A. Harper. 2013. Impacts on South Carolina's timber production over the last five decades. Carolina Forestry Journal 2013(1):6-7.

Office of Budget and Management. 2017. North American Industry Classification System, United States, 2017. Washington, DC: Executive Office of the President, Office of Budget and Management.

Oswalt, S.N., W.B. Smith, P.D. Miles, and S.A. Pugh. 2014. Forest Resources of the United States: A Technical Document Supporting the Forest Service Update of the 2010 RPA Assessment (General Technical Report WO-91). Washington, DC: USDA Forest Service.

Rose, A.K. 2016. South Carolina's Forests, 2011 (Resource Bulletin SRS-2080). Asheville, NC: USDA Forest Service, Southern Research Station.

Rose, A.K. 2015. Forests of South Carolina, 2014 (Resource Update FS-53). Asheville, NC: U.S.D.A. Forest Service, Southern Research Station.

Sheffield, R.M. 1979. Forest Statistics for South Carolina, 1978 (Resource Bulletin SE-50). Asheville, NC: USDA Forest Service, Southeastern Forest Experiment Station.

South Carolina Forestry Association. 2016. Investing in forestry. In South Carolina Forestry (2016 Annual Magazine). Columbia, SC: South Carolina Forestry Association. p. 45-55.

South Carolina Forestry Commission. 2014. SC Forest Products Industry Export Report. Columbia, SC: South Carolina Forestry Commission.

South Carolina Forestry Commission. 2017a. Forest Products Mill Directory for South Carolina. Columbia, SC: South Carolina Forestry Commission. Online at: https://www.state.sc.us/forest/refind.htm.

South Carolina Forestry Commission. 2017b. A Short History of Forest Industry in South Carolina. Columbia, SC: South Carolina Forestry Commission. Online at: https://www.state.sc.us/forest/scindust.htm.

Tansey, J.B. 1987. Forest Statistics for South Carolina, 1986 (Resource Bulletin SE-93). Asheville, NC: USDA Forest Service, Southeastern Forest Experiment Station.

U.S. Fish and Wildlife Service. 2014. 2011 National Survey of Fishing, Hunting, and Wildlife-Associated Recreation: South Carolina (FHW/11-SC (RV)). Washington, DC: U.S. Department of the Interior, Fish and Wildlife Service and U.S. Department of Commerce, U.S. Census Bureau.

Watson, P., J. Wilson, D. Thilmany, and S. Winter. 2007. Determining economic contributions and impacts: What is the difference and why do we care? Journal of Regional Analysis and Policy 37(2):140-146.

Watson, P., S. Cooke, D. Kay, and G. Alward. 2015. A method for improving economic contribution studies for regional analysis. Journal of Regional Analysis and Policy 45(1): 1-15.

Williams, B.L, T.J. Straka, and R.A. Harper. 2012. Size of forest holding and family forests: Implications for forest management in South Carolina. Carolina Forestry Journal 2012(3):4-5.

Willis, D.B., and T.J. Straka. 2016. The Economic Contribution of Natural Resources to South Carolina's Economy (FW 13). Clemson, SC: Clemson University Experiment Station.

Appendix

Table A1. Description of Aggregated Sectors Used in IMPLAN Model, by IMPLAN and NAICS Codes.

TIMBER

IMPLAN CODE 15 - Forestry, forest products, and tract production. NAICS CODE for Timber Tract Operations (113110) comprises establishments primarily engaged in the operation of timber tracts for the purpose of selling standing timber. Forest Nurseries and Gathering of Forest Products (113210) comprises establishments primarily engaged in (1) growing trees for reforestation and/or (2) gathering forest products, such as gums, barks, balsam needles, rhizomes, fibers, Spanish moss, ginseng, and truffles.

IMPLAN CODE 19* - Support activities for agriculture and forestry. NAICS CODE for Support Activities for Forestry (115310) comprises establishments primarily engaged in performing particular support activities related to timber production, wood technology, forestry economics and marketing, and forest protection. These establishments may provide support activities for forestry, such as estimating timber, forest firefighting, forest pest control, treating burned forests from the air for reforestation or on an emergency basis, and consulting on wood attributes and reforestation. To estimate the amount of this sector due to forestry activities only, a calibration ratio was estimated using the Quarterly Census of Employment and Wages EW (2015) employment estimates for the sectors NAICS 115111, 115112, 115113, 115114, 115115, 115116, 115210, and 115310 in South Carolina (Bureau of Labor Statistics 2015).

IMPLAN CODE 6* - Greenhouse, nursery, and Christmas tree production. NAICS CODE for Nursery and Tree Production (111421) comprises establishments primarily engaged in (1) growing nursery products, nursery stock, shrubbery, bulbs, fruit stock, sod, and so forth, under cover or in open fields and/or (2) growing short rotation woody trees with a growth and harvest cycle of 10 years or less for pulp or tree stock. Includes Christmas tree growing. Truss Manufacturing (321214) comprises establishments primarily engaged in manufacturing laminated or fabricated wood roof and floor trusses. To estimate the amount of this sector due to forestry activities only, a calibration ratio was estimated using the Quarterly Census of Employment and Wages EW (2015) employment estimates for the sectors NAICS 111411, 111419, 111421, and 111422 in South Carolina (Bureau of Labor Statistics 2015).

IMPLAN CODE 469* - Landscaping and tree services (including pine straw). NAICS CODE DESCRIPTION: Landscaping Services (561730) comprises (1) establishments primarily engaged in providing landscape care and maintenance services and/or installing trees, shrubs, plants, lawns, or gardens and (2) establishments primarily engaged in providing these services along with the design of landscape plans and/or the construction (i.e., installation) of walkways, retaining walls, decks, fences, ponds, and similar structures. To estimate the amount of this sector due to forestry activities only, employment estimates were based on the database of the primary & secondary product businesses in South Carolina as well as a list of pine balers provided by the S.C. Forestry Commission (South Carolina Forestry Commission 2017a)

LOGGING

IMPLAN CODE 16 - Commercial logging. NAICS CODE for Logging (113310) comprises establishments primarily engaged in one or more of the following: (1) cutting timber; (2) cutting and transporting timber; and (3) producing wood chips in the field.

SOLID WOOD PRODUCTS

IMPLAN CODE 134 - Sawmills. NAICS CODE for Sawmills (321113) comprises establishments primarily engaged in sawing dimension lumber, boards, beams, timbers, poles, ties, shingles, shakes, siding, and wood chips from logs or bolts. Sawmills may plane the rough lumber that they make with a planing machine to achieve smoothness and uniformity of size.

IMPLAN CODE 135 - Wood preservation. NAICS CODE for Wood Preservation (321114): comprises establishments primarily engaged in (1) treating wood sawed, planed, or shaped in other establishments with creosote or other preservatives, such as alkaline copper quat, copper azole, and sodium borates, to prevent decay and to protect against fire and insects and/or (2) sawing round wood poles, pilings, and posts and treating them with preservatives.

IMPLAN CODE 136 - Veneer and plywood manufacturing. NAICS CODE for Hardwood Veneer and Plywood Manufacturing (321211) comprises establishments primarily engaged in manufacturing hardwood veneer and/or hardwood plywood. Softwood Veneer and Plywood Manufacturing (321212) comprises establishments primarily engaged in manufacturing softwood veneer and/or softwood plywood.

IMPLAN CODE 137 - Engineered wood member and truss manufacturing. NAICS CODE for Engineered Wood Member (except Truss) Manufacturing (321213) comprises establishments primarily engaged in manufacturing fabricated or laminated wood arches and/or other fabricated or laminated wood structural members.

IMPLAN CODE 138 - Reconstituted wood product manufacturing. NAICS CODE for Reconstituted Wood Product

Manufacturing (321219) comprises establishments primarily engaged in manufacturing reconstituted wood sheets and boards.

IMPLAN CODE 139 - Wood windows and door manufacturing. NAICS CODE for Wood Window and Door Manufacturing (321911) comprises establishments primarily engaged in manufacturing window and door units, sash, window and door frames, and doors from wood or wood clad with metal or plastics.

IMPLAN CODE 140 - Cut stock, resawing lumber, and planning. NAICS CODE for Cut Stock, Resawing Lumber, and Planing (321912) comprises establishments primarily engaged in one or more of the following: (1) manufacturing dimension lumber from purchased lumber; (2) manufacturing dimension stock (i.e., shapes) or cut stock; (3) resawing the output of sawmills; and (4) planing purchased lumber. These establishments generally use woodworking machinery, such as jointers, planers, lathes, and routers to shape wood.

IMPLAN CODE 141 - Other millwork, including flooring. NAICS CODE for Other Millwork, including Flooring, (321918) comprises establishments primarily engaged in manufacturing millwork (except wood windows, wood doors, and cut stock).

IMPLAN CODE 142 - Wood container & pallet manufacturing. NAICS CODE for Wood Container and Pallet Manufacturing (321920) comprises establishments primarily engaged in manufacturing wood pallets, wood box shook, wood boxes, other wood containers, and wood parts for pallets and containers.

IMPLAN CODE 144 - Prefabricated wood building manufacturing. NAICS CODE for Prefabricated Wood Building Manufacturing (321992) comprises establishments primarily engaged in manufacturing prefabricated wood buildings and wood sections and panels for prefabricated wood buildings.

IMPLAN CODE 145 - All other miscellaneous wood product manufacturing. NAICS CODE for All Other Miscellaneous Wood Product Manufacturing (321999) comprises establishments primarily engaged in manufacturing wood products (except establishments operating sawmills and preservation facilities; establishments manufacturing veneer, engineered wood products, millwork, wood containers, pallets, and wood container parts; and establishments making manufactured homes (i.e., mobile homes) and prefabricated buildings and components).

IMPLAN CODE 395* - Wholesale trade. NAICS CODE for Lumber, Plywood, Millwork, and Wood Panel Merchant Wholesalers (423310) comprises establishments primarily engaged in the merchant wholesale distribution of lumber; plywood; reconstituted wood fiber products; wood fencing; doors and windows and their frames (all materials); wood roofing and siding; and/or other wood or metal millwork. To estimate the amount of this sector due to forestry export activities only, a calibration ratio was estimated using Quarterly Census of Employment and Wages EW (2015) employment estimate for the sector NAICS 423310 in the Charleston Harbor (Charleston County), South Carolina (Bureau of Labor Statistics 2015).

FURNITURE & RELATED PRODUCTS MANUFACTURING

IMPLAN CODE 368 - Wood kitchen cabinet and countertop manufacturing. NAICS CODE for Wood Kitchen Cabinet and Countertop Manufacturing (337110) comprises establishments primarily engaged in manufacturing wood or plastics laminated on wood kitchen cabinets, bathroom vanities, and countertops (except freestanding). The cabinets and counters may be made on a stock or custom basis.

IMPLAN CODE 369 - Upholstered household furniture manufacturing. NAICS CODE for Upholstered Household Furniture Manufacturing (337121) comprises establishments primarily engaged in manufacturing upholstered household-type furniture. The furniture may be made on a stock or custom basis.

IMPLAN CODE 370 - Nonupholstered wood household furniture manufacturing. NAICS CODE for Nonupholstered Wood Household Furniture Manufacturing (337122) comprises establishments primarily engaged in manufacturing nonupholstered wood household-type furniture and freestanding cabinets (except television, stereo, and sewing machine cabinets). The furniture may be made on a stock or custom basis and may be assembled or unassembled (i.e., knockdown).

IMPLAN CODE 372* - Institutional furniture manufacturing. NAICS CODE for Institutional Furniture Manufacturing (337127) comprises establishments primarily engaged in manufacturing institutional-type furniture (e.g., library, school, theater, and church furniture). Included in this industry are establishments primarily engaged in manufacturing general purpose hospital, laboratory, and dental furniture (e.g., tables, stools, and benches).The furniture may be made on a stock or custom basis and may be assembled or unassembled (i.e., knockdown). To estimate the amount of this sector due to forestry activities only, a calibration ratio was estimated using Quarterly Census of Employment and Wages EW (2015) employment estimates for the sectors NAICS 337121, 337122, 337124, and 337125 in South Carolina (Bureau of Labor Statistics 2015).

IMPLAN CODE 373 - Wood office furniture manufacturing. NAICS CODE for Wood Office Furniture Manufacturing (337211) comprises establishments primarily engaged in manufacturing wood office-type furniture. The furniture may be made on a stock or custom basis and may be assembled or unassembled (i.e., knockdown).

IMPLAN CODE 374 - Custom architectural woodwork and millwork. NAICS CODE for Custom Architectural Woodwork and Millwork Manufacturing (337212) comprises establishments primarily engaged in manufacturing custom designed interiors

consisting of architectural woodwork and fixtures utilizing wood, wood products, and plastics laminates. All of the industry output is made to individual order on a job shop basis and requires skilled craftsmen as a labor input. A job might include custom manufacturing of display fixtures, gondolas, wall shelving units, entrance and window architectural detail, sales and reception counters, wall paneling, and matching furniture.

IMPLAN CODE 376* - Showcase, partition, shelving, and locker manufacturing. NAICS CODE for Showcase, Partition, Shelving, and Locker Manufacturing (337215) comprises establishments primarily engaged in manufacturing wood and nonwood office and store fixtures, shelving, lockers, frames, partitions, and related fabricated products of wood and nonwood materials, including plastics laminated fixture tops. The products are made on a stock or custom basis and may be assembled or unassembled (i.e., knockdown). Establishments exclusively making furniture parts (e.g., frames) are included in this industry. To estimate the amount of this sector due to forestry activities only, a calibration ratio was estimated using Quarterly Census of Employment and Wages EW (2015) employment estimates for the sectors NAICS 337211, 337212, and 337214 in South Carolina (Bureau of Labor Statistics 2015).

IMPLAN CODE 377 - Mattress manufacturing. NAICS CODE for Mattress Manufacturing (337910) comprises establishments primarily engaged in manufacturing innerspring, box spring, and noninnerspring mattresses, including mattresses for waterbeds.

IMPLAN CODE 378 - Blind and shade manufacturing. NAICS CODE for Blind and Shade Manufacturing (337920) comprises establishments primarily engaged in manufacturing one or more of the following: venetian blinds, other window blinds, and shades; curtain and drapery rods and poles; and/or curtain and drapery fixtures. The blinds and shades may be made on a stock or custom basis and may be made of any material.

IMPLAN CODE 393 - Burial casket manufacturing. NAICS CODE for Burial Casket Manufacturing (339995) comprises establishments primarily engaged in manufacturing burial caskets, cases, and vaults (except concrete).

PULP AND PAPER PRODUCTS

IMPLAN CODE 146 - Pulp mills. NAICS CODE for Pulp Mills (322110) comprises establishments primarily engaged in manufacturing pulp without manufacturing paper or paperboard. The pulp is made by separating the cellulose fibers from the other impurities in wood or other materials, such as used or recycled rags, linters, scrap paper, and straw.

IMPLAN CODE 147 - Paper mills. NAICS CODE for Paper (except Newsprint) Mills (322121) comprises establishments primarily engaged in manufacturing paper (except newsprint and uncoated groundwood paper) from pulp. These establishments may manufacture or purchase pulp. In addition, the establishments may also convert the paper they make. Newsprint Mills (322122) comprises establishments primarily engaged in manufacturing newsprint and uncoated groundwood paper from pulp. These establishments may manufacture or purchase pulp. In addition, the establishments may also convert the paper they make.

IMPLAN CODE 148 - Paperboard mills. NAICS CODE for Paperboard Mills (322130) comprises establishments primarily engaged in manufacturing paperboard (e.g., can/drum stock, container board, corrugating medium, folding carton stock, linerboard, tube) from pulp. These establishments may manufacture or purchase pulp. In addition, the establishments may also convert the paperboard they make.

IMPLAN CODE 149 - Paperboard container manufacturing. NAICS CODE for Corrugated and Solid Fiber Box Manufacturing (322211) comprises establishments primarily engaged in laminating purchased paper or paperboard into corrugated or solid fiber boxes and related products, such as pads, partitions, pallets, and corrugated paper without manufacturing paperboard. These boxes are generally used for shipping. Folding Paperboard Box Manufacturing (322212) comprises establishments primarily engaged in converting paperboard (except corrugated) into folding paperboard boxes without manufacturing paper and paperboard. Other Paperboard Container Manufacturing (322219) comprises establishments primarily engaged in converting paperboard into paperboard containers (except corrugated, solid fiber, and folding paperboard boxes) without manufacturing paperboard.

IMPLAN CODE 150 - Paper bag and coated and treated paper manufacturing. NAICS CODE for Paper Bag and Coated and Treated Paper Manufacturing (322220) comprises establishments primarily engaged in one or more of the following: (1) cutting and coating paper and paperboard; (2) cutting and laminating paper, paperboard, and other flexible materials (except plastics film to plastics film); (3) manufacturing bags, multiwall bags, sacks of paper, metal foil, coated paper, laminates, or coated combinations of paper and foil with plastics film; (4) manufacturing laminated aluminum and other converted metal foils from purchased foils; and (5) surface coating paper or paperboard.

IMPLAN CODE 151 - Stationery product manufacturing. NAICS CODE for Stationery Product Manufacturing (322230) comprises establishments primarily engaged in converting paper or paperboard into products used for writing, filing, art work, and similar applications.

IMPLAN CODE 152 - Sanitary paper product manufacturing. NAICS CODE for Sanitary Paper Product Manufacturing (322291) comprises establishments primarily engaged in converting purchased sanitary paper stock or wadding into sanitary paper products, such as facial tissues, handkerchiefs, table napkins, toilet paper, towels, disposable diapers, sanitary napkins, and tampons.

IMPLAN CODE 165 - Other basic organic chemical manufacturing. NAICS CODE for Cyclic Crude, Intermediate, and Gum and Wood Chemical Manufacturing (325194) comprises establishments primarily engaged in one or more of the following: (1) distilling wood or gum into products, such as tall oil and wood distillates; (2) distilling coal tars; (3) manufacturing wood or gum chemicals, such as naval stores, natural tanning materials, charcoal briquettes, and charcoal (except activated); and (4) manufacturing cyclic crudes or cyclic intermediates (i.e., hydrocarbons, except aromatic petrochemicals) from refined petroleum or natural gas.

IMPLAN CODE 153 - Other basic organic chemical manufacturing. NAICS CODE for Cyclic Crude, Intermediate, and Gum and Wood Chemical Manufacturing (325194) comprises establishments primarily engaged in one or more of the following: (1) distilling wood or gum into products, such as tall oil and wood distillates; (2) distilling coal tars; (3) manufacturing wood or gum chemicals, such as naval stores, natural tanning materials, charcoal briquettes, and charcoal (except activated); and (4) manufacturing cyclic crudes or cyclic intermediates (i.e., hydrocarbons, except aromatic petrochemicals) from refined petroleum or natural gas.

IMPLAN CODE 47* - Electric power generation – biomass. NAICS CODE for Biomass Electric Power Generation (221117) comprises establishments primarily engaged in operating biomass electric power generation facilities. These facilities use biomass (e.g., wood, waste, alcohol fuels) to produce electric energy. The electric energy produced in these establishments is provided to electric power transmission systems or to electric power distribution systems. To estimate the amount of this sector due to forestry activities only, employment estimates were based on the database of the primary & secondary product businesses in South Carolina as well as database provided by the S.C. Forestry Commission (South Carolina Forestry Commission 2017a).

FOREST-BASED RECREATION

IMPLAN CODE 18* - Commercial hunting & trapping (in forestlands). NAICS CODE for Hunting and Trapping (114210) comprises establishments primarily engaged in one or more of the following: (1) commercial hunting and trapping; (2) operating commercial game preserves, such as game retreats; and (3) operating hunting preserves. To estimate the amount of this sector due to hunting & wildlife watching (excluding fishing) in forestlands, an adjustment was applied to the industry output estimates for the IMPLAN sector 18 (Appendix Table 1) in the economic contribution study by Willis and Straka (2016).

* Adjustment or scaling applied to the forestry sector only. See “Detailed Descriptions” in *North American Industry Classification System, United States, 2017* (Office of Budget and Management 2017).

Table A2. Detailed forest industry sector total contribution, 2017.

IMPLAN Sector	Forestry Industry Sector	Total Contributions, 2017 Employment (Jobs)	Output (2017 Dollars)	Labor Income (2017 Dollars)
6	Greenhouse, nursery, and Christmas tree production	1,716	164,268,889	54,340,329
15	Forestry, forest products, and tract production	969	95,869,119	44,281,658
16	Commercial logging	6,622	640,955,669	308,558,251
18	Commercial hunting & trapping (in forestlands)	4,156	544,684,312	106,556,164
19	Support activities for agriculture and forestry	994	85,624,555	36,365,228
47	Electric power generation – biomass	582	145,752,670	33,847,190
134	Sawmills	6,866	1,254,641,373	346,078,367
135	Wood preservation	2,253	622,359,770	112,995,039
136	Veneer and plywood manufacturing	4,009	787,712,158	206,912,466
137	Engineered wood member and truss manufacturing	886	166,898,013	42,876,642
138	Reconstituted wood product manufacturing	2,021	600,444,580	121,204,306
139	Wood windows and door manufacturing	892	170,082,859	44,684,403
140	Cut stock, resawing lumber, and planning	386	76,703,036	15,404,025
141	Other millwork, including flooring	1,246	222,855,616	53,256,305
142	Wood container & pallet manufacturing	1,778	255,270,594	66,900,564
144	Prefabricated wood building manufacturing	599	109,725,019	28,033,695
145	All other miscellaneous wood product manufacturing	1,025	168,833,632	42,542,817
146	Pulp mills	68	19,968,872	5,469,060
147	Paper mills	5,558	1,998,980,550	357,112,528
148	Paperboard mills	13,386	4,390,747,044	818,198,522
149	Paperboard container manufacturing	10,222	2,996,394,435	643,840,762
150	Paper bag and coated and treated paper manufacturing	3,457	1,125,940,326	201,578,014
151	Stationery product manufacturing	1,210	393,198,372	108,285,819
152	Sanitary paper product manufacturing	5,456	2,479,409,483	334,142,705
153	Other basic organic chemical manufacturing	1,675	429,952,689	97,679,531
165	Other basic organic chemical manufacturing	60	28,985,127	3,196,806
368	Wood kitchen cabinet and countertop manufacturing	2,340	326,757,789	93,039,612
369	Upholstered household furniture manufacturing	92	17,788,052	3,634,712
370	Nonupholstered wood household furniture manufacturing	263	40,678,974	10,122,186
372	Institutional furniture manufacturing	63	10,596,486	2,523,250
373	Wood office furniture manufacturing	36	6,377,377	1,156,841
374	Custom architectural woodwork and millwork	163	25,310,800	6,927,571
376	Showcase, partition, shelving, and locker manufacturing	743	150,986,991	34,873,260
377	Mattress manufacturing	911	328,759,396	44,889,173
378	Blind and shade manufacturing	76	11,290,567	2,772,980
393	Burial casket manufacturing	32	4,561,821	1,277,975
395	Wholesale trade	50	8,948,851	2,823,070
469	Landscaping and tree services (including pine straw)	748	49,674,067	20,551,061
531	Employment and payroll of state government, non-education	485	43,719,188	27,872,563
532	Employment and payroll of state government, education	25	1,866,225	1,191,175
535	Employment and payroll of federal government, non-military	307	41,444,758	24,154,168
	Total	**84,424**	**21,045,020,105**	**4,512,150,795**

Study sponsors

Clemson University
South Carolina Forestry Commission
South Carolina Forestry Foundation
South Carolina Timber Producers Association
South Carolina Tree Farm Committee
Sustainable Forestry Initiative State Implementation Committee